A computational theory of temporal inference

Sangeet Khemlani
Naval Research Laboratory

Anthony Harrison
Naval Research Laboratory

Greg Trafton
Naval Research Laboratory

Abstract: We describe a novel model-based theory of how individuals reason deductively about temporal relations. It posits that temporal assertions refer to mental models – iconic representations of possibilities – of events (Khemlani, Harrison, & Trafton, 2015; Schaeken, Johnson-Laird, & d'Ydewalle, 1996). In line with recent accounts of spatial reasoning (Ragni & Knauff, 2013), the theory posits that individuals tend to build a single preferred model of a temporal description. The more models necessary to yield a correct answer, the harder that problem is. The theory is implemented in a computer program, mReasoner, which draws temporal deductions by building models. It varies four separate factors in the process: the size of a model, its contents, the propensity to consider alternative models, and the propensity to revise initial conclusions. Two studies corroborated the predictions of the theory and its computational implementation. We conclude by discussing temporal and relational inference more broadly.